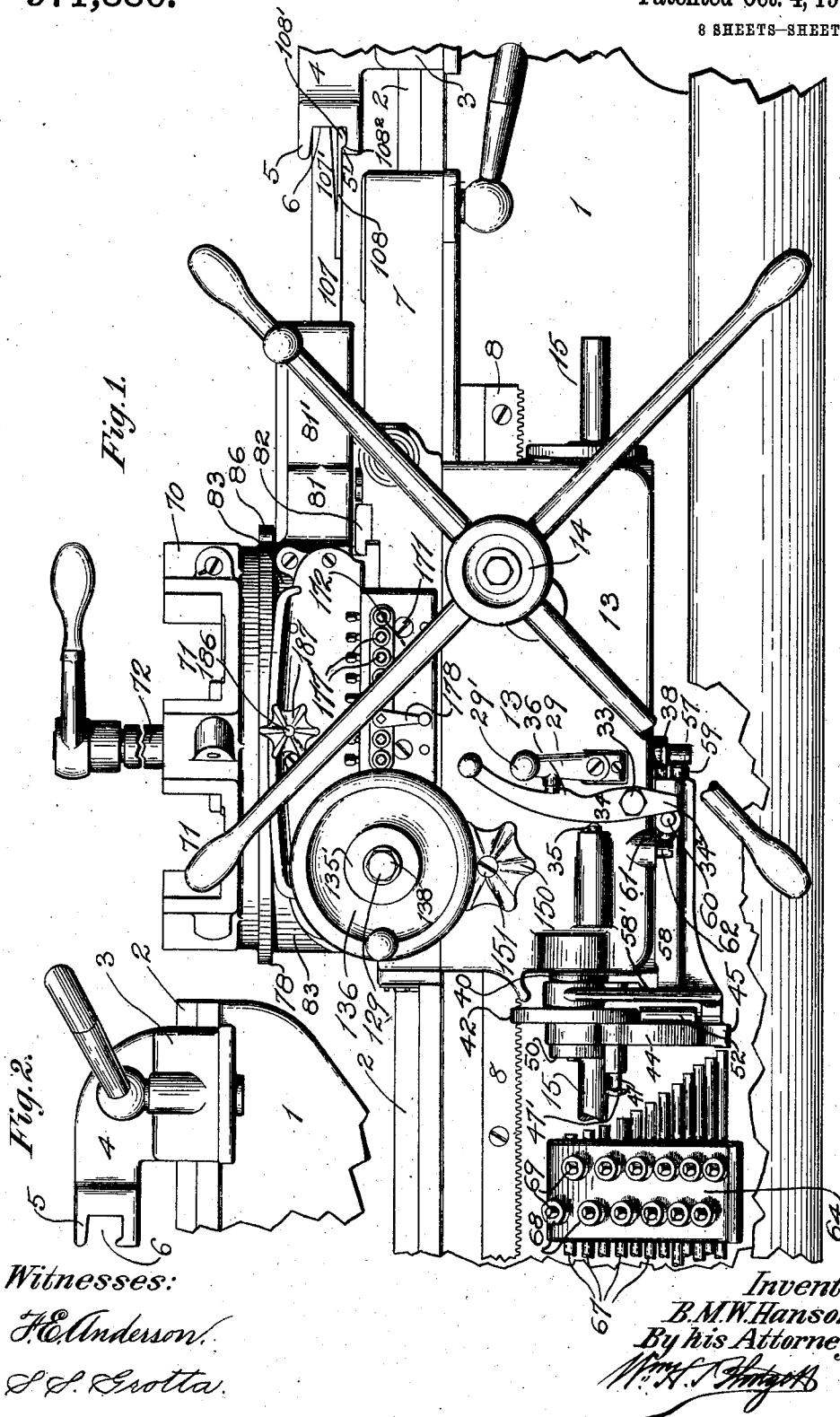


B. M. W. HANSON.
TURRET LATHE.
APPLICATION FILED FEB. 5, 1906.

971,886.

Patented Oct. 4, 1910.

8 SHEETS—SHEET 1.



Witnesses:

H. E. Anderson.
S. S. Grotta.

Inventor:

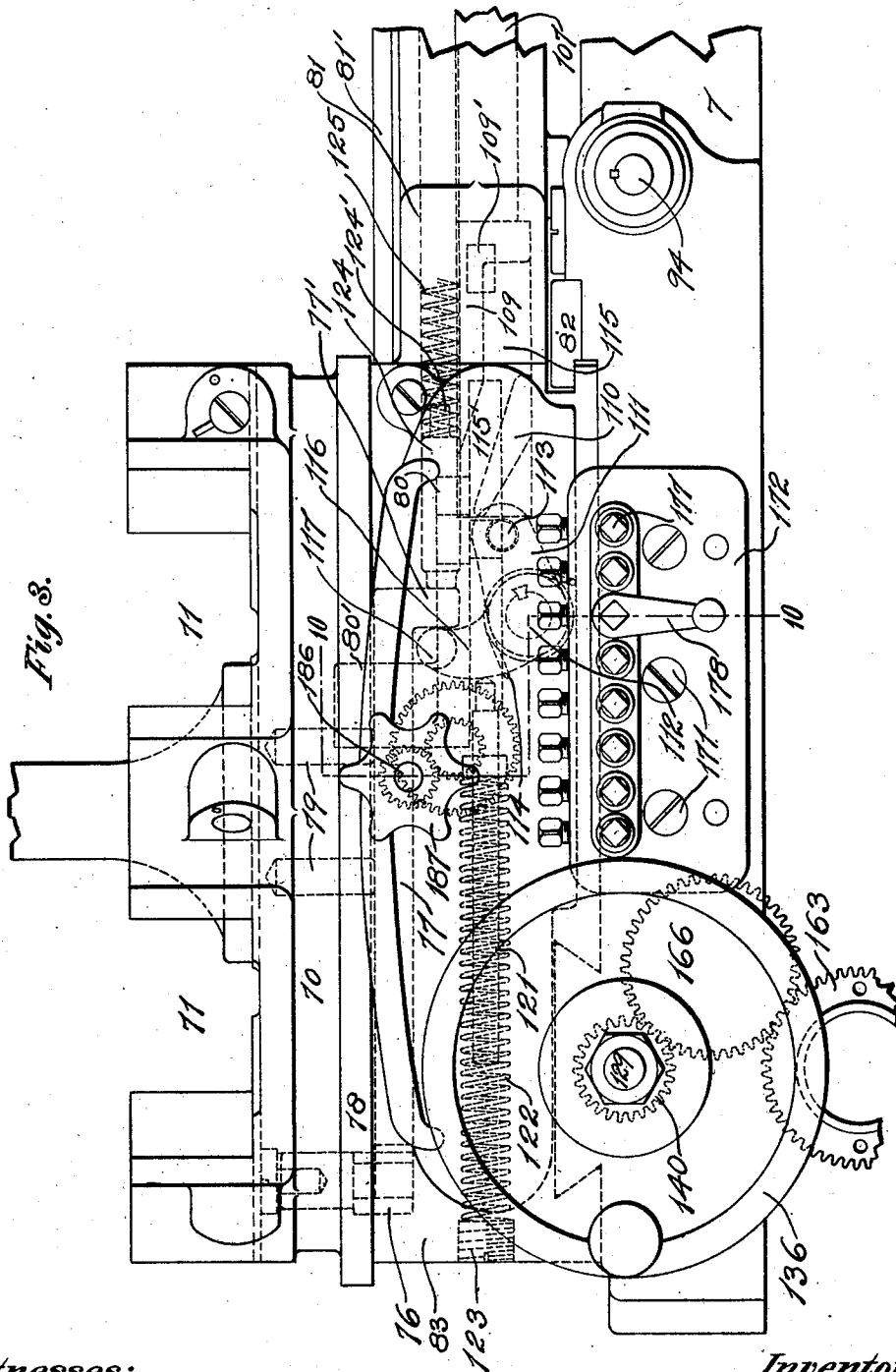
B. M. W. Hanson,
By his Attorney,

M. H. J. Hight.

TURRET LATHE.

Patented Oct. 4, 1910.

971,886.



F. E. Anderson.

Inventor:

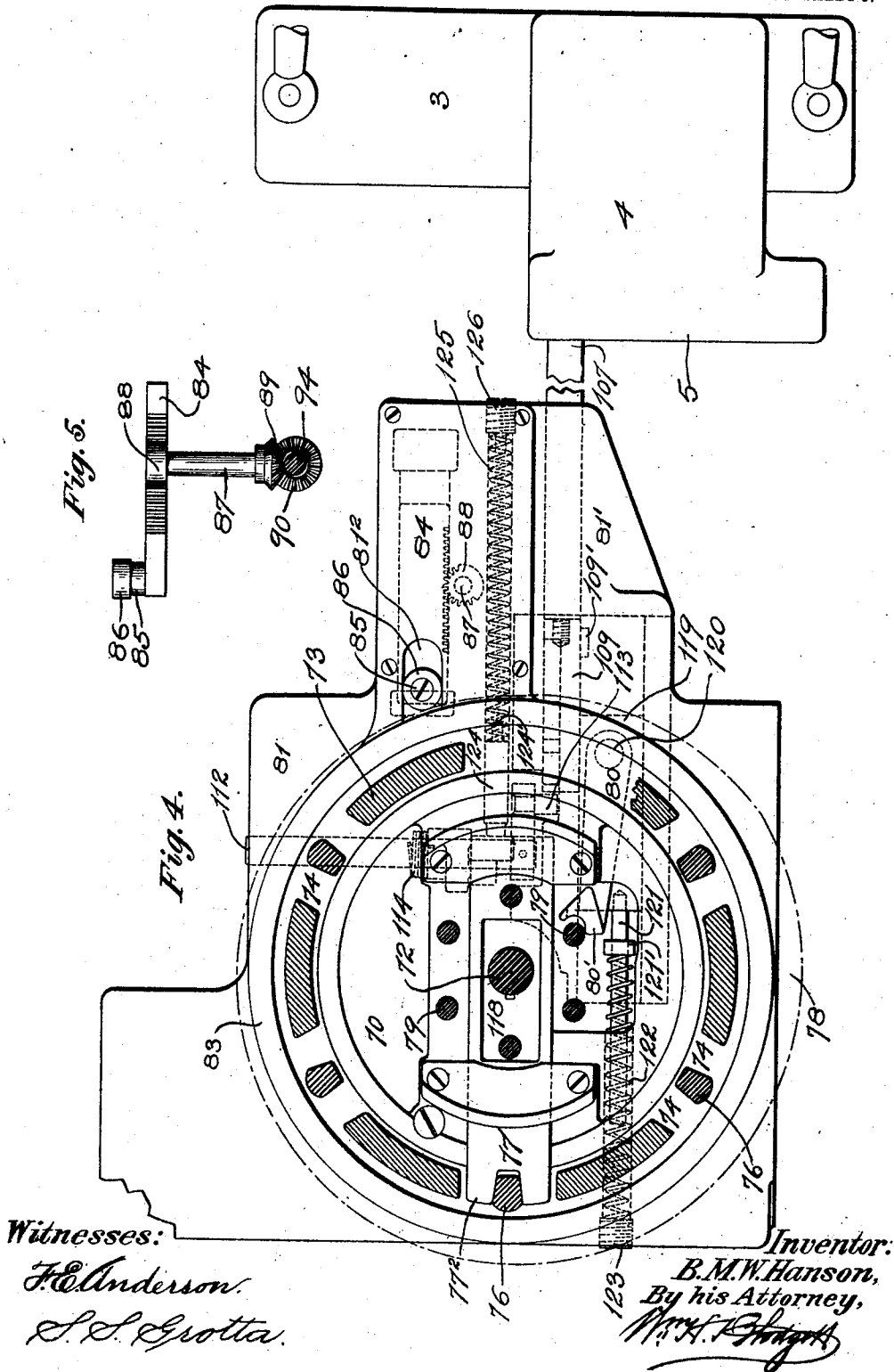
*B. M. W. Hanson,
By his Attorney,*

Wm. L. F. Fitzgerald

971,886.

Patented Oct. 4, 1910.

8 SHEETS—SHEET 3.



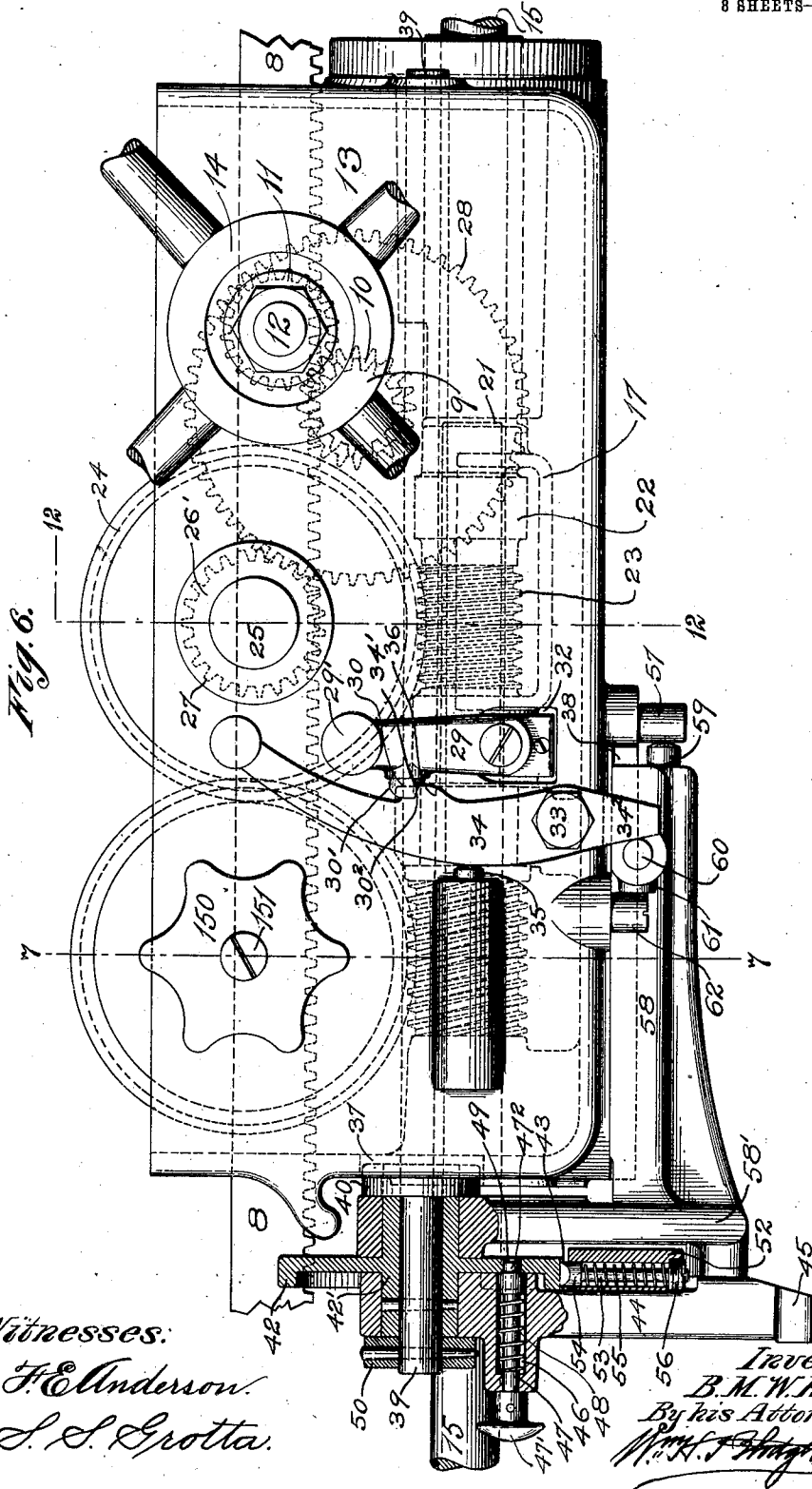
B. M. W. HANSON.
TURRET LATHE.

APPLICATION FILED FEB. 5, 1906.

971,886.

Patented Oct. 4, 1910.

8 SHEETS—SHEET 4.



Witnesses:

F. C. Anderson.
S. S. Grotta.

Inventor:

B. M. W. Hanson.

By his Attorney,

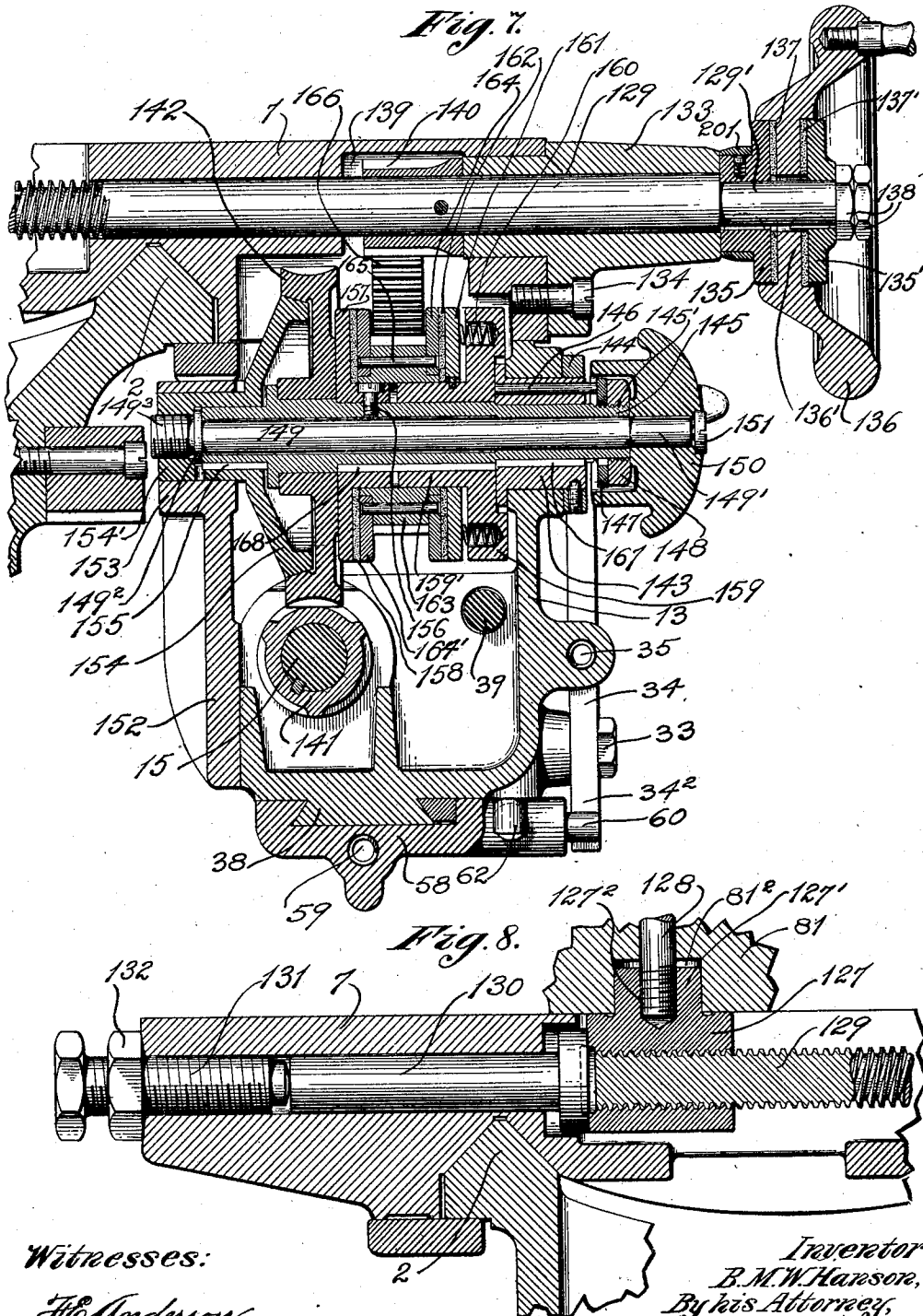
W. H. F. Wright.

B. M. W. HANSON.
TURRET LATHE.
APPLICATION FILED FEB. 5, 1908.

971,886.

Patented Oct. 4, 1910.

8 SHEETS—SHEET 5.



Witnesses:

J. H. Anderson.
S. S. Grotta.

Inventor:

B. M. W. Hanson,
By his Attorney,
W. H. H. H.

971,886.

Patented Oct. 4, 1910.

8 SHEETS—SHEET 6.

Fig. 9.

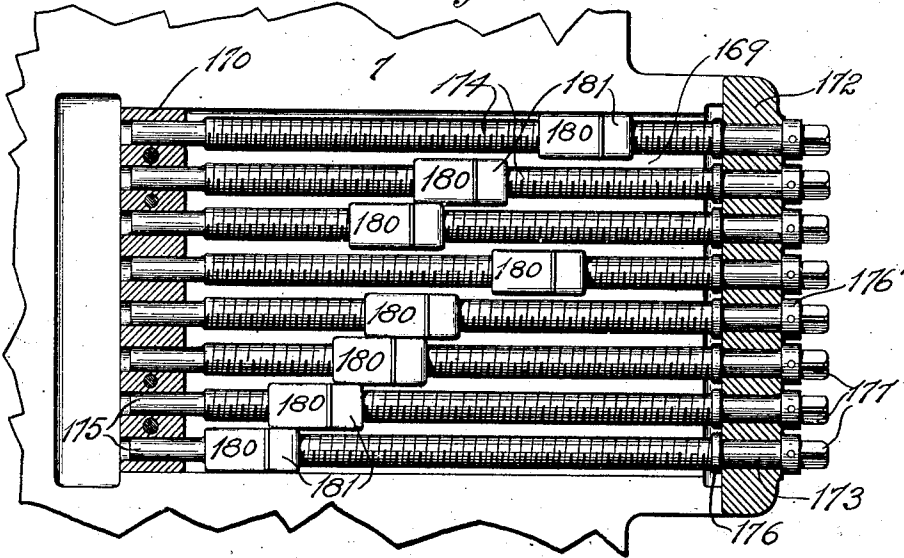


Fig. 10.

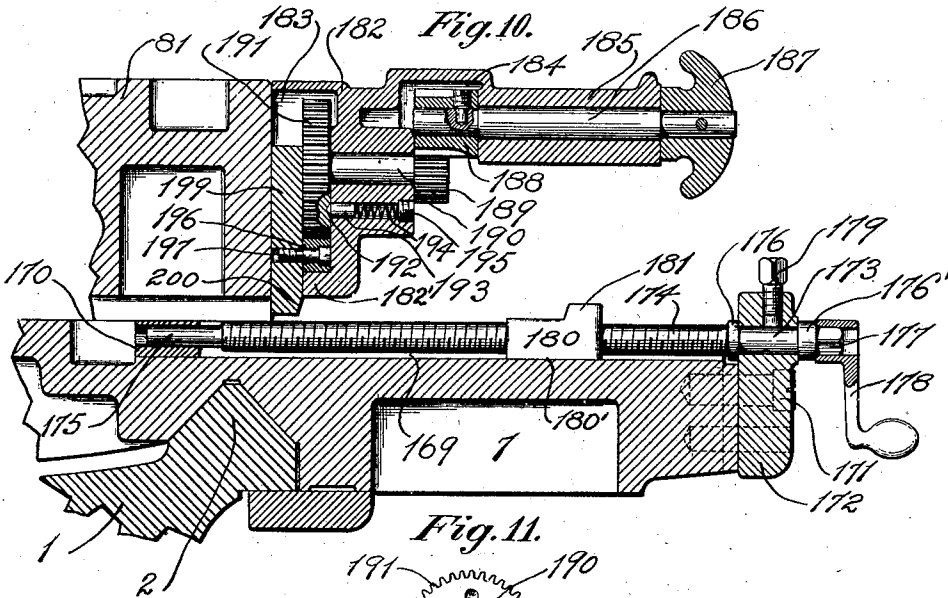
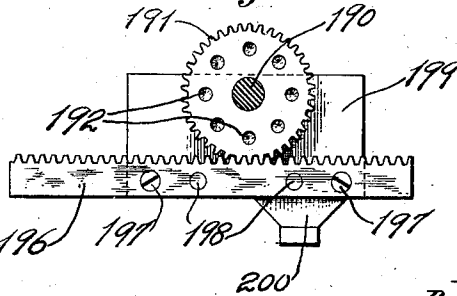


Fig. 11.



Witnesses:

F. C. Anderson.

S. L. Grotta

Inventor:

B. M. W. Hanson,
By his Attorney,

Wm. H. P. Smith

B. M. W. HANSON.

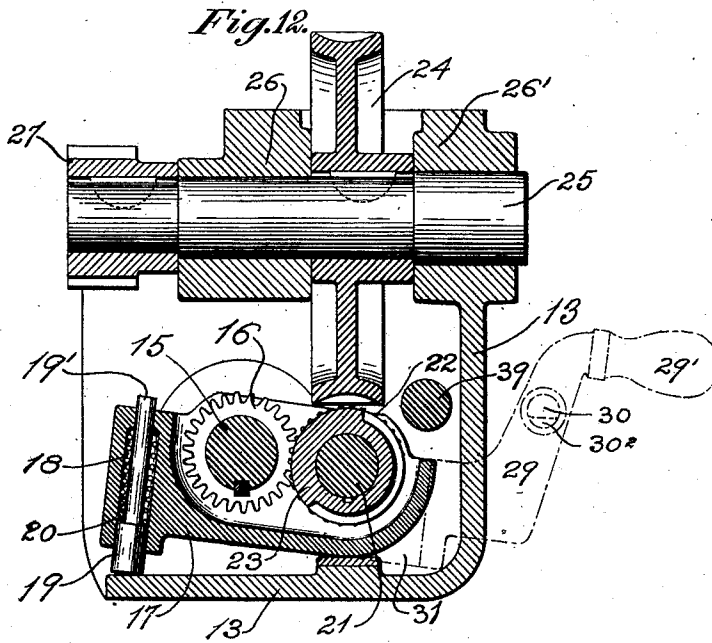
TURRET LATHE.

APPLICATION FILED FEB. 5, 1906.

Patented Oct. 4, 1910.

8 SHEETS—SHEET 7.

971,886.



Witnesses:

H. C. Anderson.

S. S. Grotta.

Inventor:

B. M. W. Hanson.

By his Attorney,

Wm. H. J. Hargis

B. M. W. HANSON.
TURRET LATHE.
APPLICATION FILED FEB. 5, 1906.

971,886.

Patented Oct. 4, 1910.

8 SHEETS—SHEET 8.

Fig. 14.

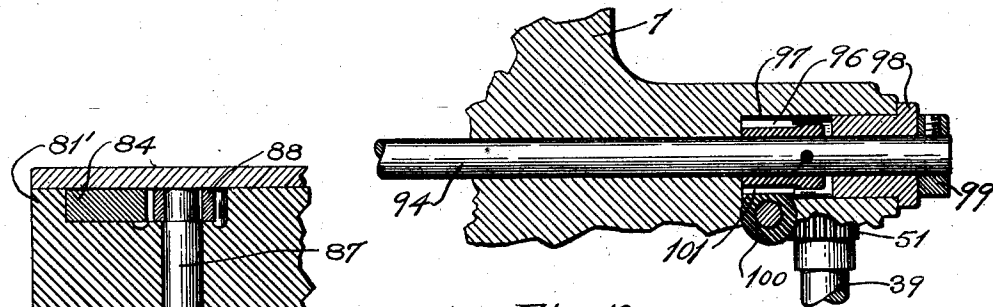
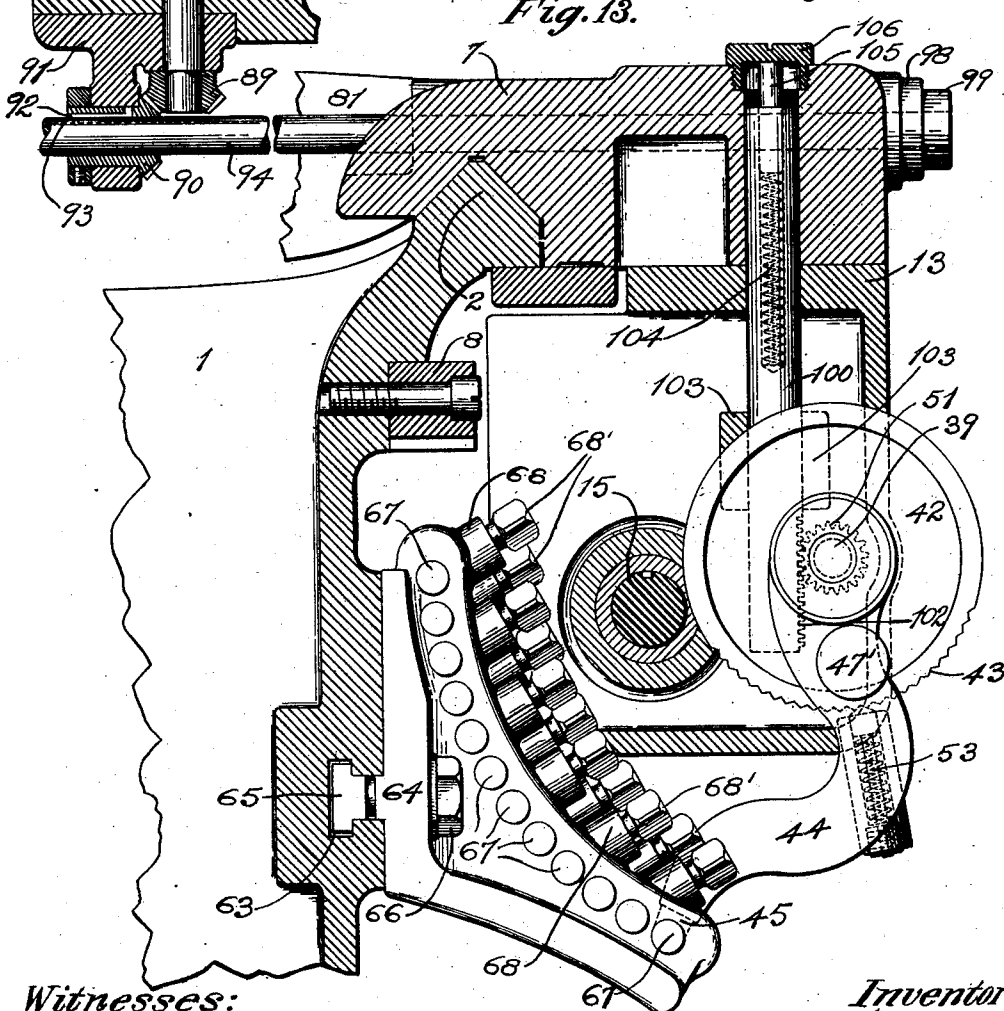


Fig. 13.



Witnesses:

H. Anderson.
S. S. Grotta.

Inventor:
B. M. W. Hanson,
By his Attorney
Wm. F. Smith

UNITED STATES PATENT OFFICE.

BENGT M. W. HANSON, OF HARTFORD, CONNECTICUT, ASSIGNOR TO PRATT & WHITNEY COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF NEW JERSEY.

TURRET-LATHE.

971,886.

Specification of Letters Patent.

Patented Oct. 4, 1910.

Application filed February 5, 1906. Serial No. 299,557.

To all whom it may concern:

Be it known that I, BENGT M. W. HANSON, a citizen of Sweden, who have declared my intention of becoming a citizen of the United States of America, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Turret-Lathes, of which the following is a specification.

This invention relates to that class of machines in which a rotary table or turret carrying a number of tools for producing different operations upon work is employed, and it comprises among its salient features a slide upon which the table or turret is mounted, means for adjusting said slide transversely of the carriage of the machine, and stop-mechanism for limiting the transverse movement of the turret-slide so that any tool may be brought into proper relation with the work to be operated upon with accuracy and expedition.

Other objects of the invention relate to improvements in the stop-mechanism carried by the support for the turret-slide, and to means mounted on the turret-slide and co-operating with said stop-mechanism to limit the movement of the turret-slide at predetermined points.

Other objects of the invention relate to improvements in means for actuating the carriage, for indexing the turret, and to improved stop-devices for limiting the longitudinal movement of said carriage in accordance with the character of work to be performed.

In the drawings accompanying this specification, Figure 1 is a side elevation of part of a turret-lathe in which my invention is shown embodied. Fig. 2 is a side elevation of part of the lathe-bed and shears, showing an adjustable abutment for coöperating with a rod for actuating the turret-indexing devices; Fig. 3 is a side elevation illustrating by dotted lines the indexing and locking devices, and also showing a hand-wheel and gearing hereinafter described. Fig. 4 is a transverse horizontal section illustrating the turret-support, the base of the turret in section, and means for indexing and locking the turret. Fig. 5 is a detail view of a slide and means for actuating said slide, the parts being mounted in an extension of the turret-support and actuating a swinging arm here-

inafter described. Fig. 6 is a side elevation, partially in section and in dotted lines, of means for actuating the carriage on which the turret-slide is mounted for transverse movement. Fig. 7 is a transverse vertical section taken on line 7, 7 of Fig. 6. Fig. 8 is a longitudinal vertical section of the screw and nut by which the turret-slide is transversely adjusted on the carriage, said figure being a continuation of Fig. 7 as shown by the broken screw in each. Fig. 9 is a plan view partially in section of said mechanism for limiting the transverse movement of the turret-slide. Fig. 10 is a section on line 10, 10 of Fig. 3. Fig. 11 is a side elevation showing the rack-and-pinion-mechanism for actuating the stop carried by the transverse slide of the turret. Fig. 12 is a section taken on line 12, 12 of Fig. 6. Fig. 13 is a transverse vertical section of the machine-bed, and of parts mounted thereon, illustrating the stop-mechanism for limiting the forward movement of the carriage upon which the turret-slide is mounted; and Fig. 14 is a sectional view hereinafter described.

Like numerals designate similar parts throughout the several views.

Referring to the drawings, the numeral 1 designates part of the bed or frame of the machine, said bed having ways or shears 2, carrying mounted for longitudinal adjustment thereon, a slide 3, provided with an overhanging arm 4,—said arm having a wide inner end 5 grooved at 6 (see Fig. 2) for a purpose hereinafter described.

Mounted upon ways or shears 2 of the bed is a carriage 7, which may be actuated by any desired means, one form being below described.

Secured to the side of the frame or bed 1 is a rack 8, and in engagement with this rack is a pinion 9, said pinion being keyed to a shaft mounted in bearings of the bed 1, (see dotted lines Fig. 6). On this shaft is a larger pinion 10 in mesh with a pinion 11, secured to another shaft 12, and rigidly secured to said shaft 12, which is mounted in an apron 13 of the carriage 7, is a capstan-wheel 14 by which the gearing may be manipulated to reciprocate the carriage upon the shears of the lathe-bed when the power-controlled mechanism is out of action.

To actuate the carriage by power a driving-shaft 15 is employed, said driving-shaft

extending through the apron and rotating in suitable bearings.

Journalled upon the driving-shaft is a drop-box 17 provided with a chamber 18, in which is mounted a plunger 19 having a stem 19'. Surrounding said stem is a coiled-spring 20, located between the end of the chamber of the drop-box and the head of the plunger. Journalled in this drop-box is a shaft 21 carrying a pinion 22 in mesh with the pinion 16 of the driving-shaft, and rigid with said shaft 21 is a worm 23, which engages a worm-wheel 24 keyed to the shaft 25, the latter being journalled in separated bearings 26—26' of the apron 13. At the end of shaft 25, adjacent to the bearing 26 is keyed a pinion 27, said pinion being in mesh with a large gear 28, which acts as a driving-gear for the shaft carrying the pinion 9 in mesh with the rack 8. As will be evident when shaft 15 is power-driven, connection is established by the gearing described, between the worm 23, said pinion 9, and the rack 8, whereby the carriage 7 may be automatically actuated, when the gearing just described is operated. To enable the power-driven mechanism to be disconnected the drop-box 17 is employed, and while any desired means may be utilized for locking said drop-box in place when the worm and worm-wheel are in mesh, one form of said means is illustrated and will now be described.

As will be evident by referring to Figs. 6 and 12 the drop-box is of trough-shape in cross-section, and it swings upon the shaft 15 in such a manner that the driving-pinion 16 and the driven pinion 22 are always in mesh, no matter what may be the position of the box, the shaft 21 rotating idly when said box is dropped to carry the worm 23 out of mesh with the worm-wheel 24.

Secured to and projecting from the drop-box 17 is an arm 29 having a grasping-handle 29', and by raising said drop-box by the means described the worm 23 and worm-wheel 24 are thrown into engagement. To lock said drop-box in its raised position the arm 29 is provided with a detent 30, having a beveled end 30', and an inclined locking-shoulder 30². This arm is secured to a projection 31 of the drop-box by a screw or otherwise, and said projection works in a slot 32 of the apron, as illustrated in Fig. 6.

Pivoted to the apron 13 by a bolt 33 is a lever 34 having a beveled stop-shoulder 34' adapted to engage the detent 30 of lever-arm 29 when the drop-box is raised, and thus to hold the worm 23 in mesh with the worm-wheel 24. A spring-actuated plunger 35 mounted in a bearing of the aprons bears against the lever 34, and serves normally to swing the upper part of said lever inward upon its pivot-bolt 33. On one of the edges of said lever is formed an incline 36, and

when the drop-box is raised to engage the worm-gear the lever will be forced back to enable the detent to pass the notch therein, and then will immediately be advanced to cause its locking-shoulder to pass beneath the complementary shoulder of said detent.

Below its pivot the extension 34² of the lever 34 is adapted to engage a stop hereinafter described for disengaging the lever, and permitting the box to drop and withdraw the worm from engagement with the worm wheel, thus arresting the feed of the carriage and permitting the same to be withdrawn by the capstan-wheel 14 and the gearing controlled thereby for driving the pinion 9 in mesh with rack 8.

In the end of apron 13 a recess 37 is formed and on its under edge said apron is provided with a guideway 38. Journalled in bearings of the carriage and apron is a shaft 39 carrying adjacent to its left-hand end a collar 40, said collar being of a diameter to fit in the recess 37 when the shaft is given a longitudinal movement in a manner hereinafter described. On the end of said shaft adjacent to said collar 40 is pinned or keyed the hub 42' of a disk 42, said disk having ratchet teeth 43 around a section of its periphery.

Sleeved upon the hub of the disk is a curved stop-arm 44 having a stop 45 projecting from its free end. In a chamber 46 of the stop-arm 44 is mounted a plunger 47 having a knob 47' and surrounding this plunger and normally tending to drive it inward is a spiral spring 48. At its inner end the plunger is reduced at 47² to enter an opening 49 in the disk 42, and lock the arm to said disk.

At its extreme inner end the shaft 39 is provided with a collar 50 which is closely adjacent to the hub 42' and the hub of the arm 44 mounted upon said hub 42' as illustrated in Fig. 6. For rocking the shaft 39 and thus adjusting the disk 42 in an arcuate path various devices may be employed and I have shown for this purpose a pinion 51 carried by the shaft 39 and actuated by means hereinafter set forth.

In a bracket 52 projecting laterally from the inner side of the arm 44 is mounted a plunger 53, said plunger having at its inner end a pawl 54 which engages the ratchet-teeth 43 of the disk 42, and being held to its work by means of a coiled spring 55 surrounding the stem of the plunger, and mounted between the pawl-head thereof and a screw 56 threaded into the bracket and through which the stem passes. By releasing the plunger 47 by means of the knob 47' the arm 44 may be swung around the hub 42' of the disk 42, and it will be held in any desired position by means of the plunger 53. Depending from the apron of the carriage is a stop 57, shown in the nature of a pin,

although it may be of any other form, said stop being located on the carriage at the end of the guideway 38 thereof.

Designated by 58 is the longitudinal arm of a bracket or support mounted for limited sliding movement in the guideway 38, and having a vertical arm 58', which is sleeved upon the hub 42' between the disk 42 and the collar 40 (see Fig. 6). In the horizontal arm is mounted a spring-actuated plunger 59, and on it is carried a horizontally projecting stop-pin 60 which is adapted to engage the free end 34² of the latch-lever 34, and a horizontal stop 61 is also mounted on the arm 58, and it engages with a stop-pin 62 depending from the apron, and serves to limit the rearward movement of the arm 58.

In the outer side of the frame 1 is formed a T-slot 63 and fitted to said outer side over the slot therein, is an angular stop-bracket 64. A T-nut 65 is fitted in the slot and a bolt designated generally by 66 passes through the bracket and is threaded into said T-nut to secure said bracket in place. By loosening this bolt the bracket may, of course, be adjusted along the line of the slot and then again secured in position. In a web of the bracket are formed a series of perforations preferably on a curved line, for the reception of stop-rods 67 of different lengths, while passing through bosses 68 on the top of the bracket are screw-bolts 68' for clamping the stop-rods in place. As will be evident by loosening these bolts any stop-rod may be adjusted longitudinally in its seat, and then again clamped in position. These stop-rods are arranged parallel to each other, and must be as many in number as there are tool-holders in the turret of the machine hereinafter described, although they may exceed said number. In the present instance twelve stop-rods are illustrated, but there may be a less number employed, provided they equal in number the tool-holding seats of the turret, as above stated.

In this class of machines it is important to control the movement of the carriage from the turret. In other words, to limit the carriage movement longitudinally when the work performed by the particular tool in use has been accomplished, and it is necessary to index the turret and bring another tool into position for operation. This result is accomplished in the present instance by means about to be described.

Designated by 70 is a tool-holding turret which is shown as of the open variety, and is provided with a series of rectangular seats 71 for holding the tool-carrying blocks. This turret may be supported for intermittent rotation, or indexing, in any desired way, and, as shown in the drawings, is mounted upon a rod 72, and is provided with a depending ring 73, slotted at intervals at 74 to receive lugs or projections 76, with

which a locking-bolt 77 may engage, as illustrated in Fig. 4. Surrounding the turret is a cam 78 of constantly increasing radius for the greater part of its circumference, the remaining portion of its periphery being concentric to the axis of the turret, and serving as a joining curve having no function. Depending from the turret are concentrically-arranged pins 79, with which the notched end 80' of an indexing-pawl 80 engages in a manner hereinafter described.

Designated by 81 is a turret slide, mounted in a way of the carriage 7 to which it is secured by a strap 82, and rising from said turret-slide is the tubular base 83 upon which the turret rests. From the turret-slide projects an extension 81', chambered to receive and guide a rack 84, carrying a stud 85 upon which is mounted an antifriction roller 86, the top of the extension 81' being slotted at 81² to permit of the passage of said roller. A shaft 87 is journaled in the extension of the turret-slide, and has splined to its upper end a toothed sector 88 and to its lower extremity a bevel-gear 89, the latter being in mesh with a bevel-pinion 90, the hub of which is journaled in a bracket 91 depending from said extension 81'. This pinion is provided with a feather 92 working in a longitudinal groove 93 of a shaft 94 journaled in the carriage 7, and having keyed thereto a spur-pinion 96,—the slide 7 being chambered at 97 to receive the pinion, and said chamber being closed at its end by a bushing 98 through which the shaft 94 passes,—longitudinal movement of said shaft being prevented by a collar 99.

In bores of the carriage 7 and apron 13 is mounted a parti-tubular plunger 100 having rack-teeth 101, at its upper end in mesh with the pinion 97, and rack-teeth 102, at its lower extremity in engagement with the barrel-pinion 51 of shaft 39. Separated bars 103 in the apron 13, serve as guides for the plunger 100, and in the bore of said plunger is mounted a coiled spring 104, upon the top of which rests a pin 105, the upper extremity of said pin bearing against the under side of a cap-screw 106, closing the bore in the carriage—see Fig. 13.

It will be seen from Figs. 4, 13 and 14 that when the turret is indexed the rack 84 will be gradually actuated by the cam 78 toward the right, thus rotating the sector 88 and shaft 87 from left to right and the bevel-pinion 89 in the same direction. As stated, this bevel-gear intermeshes with the bevel-pinion 90, and drives it, shaft 94, and spur-gear 96 in a reverse direction, or from right to left, consequently raising the rack-plunger 100 and rotating the pinion 51, shaft 39, disk 42, and stop-arm 44 from left to right, to carry the stop 45 opposite another of the stops 67.

From what has been stated it will be ap-

parent that my apparatus involves a traveling carriage, a pair of stop elements one movable with the carriage and the other supported independently of the carriage, one stop element comprising a series of stops co-operative with the other stop, and means for automatically operating one of said stop elements whereby the carriage may be stopped at different points in its travel and one of said stop elements being manually operable to control the stoppage of the carriage by said stop elements independently of the automatic stoppage.

The different parts to which I have just briefly alluded may take a variety of forms. In the present case the part 44 constitutes one of said stop elements and although it is movable with the carriage this is not essential while the series of stops 67 may present the other stop element. As will be apparent the part 44 is shiftable by hand although it is normally locked or held against movement with respect to the disk 42 by suitable means such as those described. Normally the arm 44 is rigidly coupled to the disk 42 so that the two parts operate in effect as one. Through mechanism of a suitable type the arm 44 is caused to swing so as to be brought opposite a predetermined stop of the series of stops 67. When therefore on the movement of the carriage the stop 45 strikes the preselected stop 67 the carriage feed continues the movement of the arm being arrested. This arrest of the arm causes mechanism hereinafter described to stop the further advance of the carriage. During the automatic action of the machine or when the arm 44 is being operated automatically by mechanism set in action by the turret plunger 47' rigidly connects the arm 44 with the disk 42. The arm may, however, be angularly adjusted with respect to the disk, this being rendered possible by the disengagement of said plunger from the disk by reason of which the said arm can be swung oppositely from its central and normal position to engage the stop of those stops 67 which it had just engaged when under automatic control. It will be assumed for illustration that the turret had so operated mechanism that the stop 45 will engage the third stop 67 and that it is desired to repeat this operation. This result can be readily accomplished by virtue of the adjustment set forth. To do so the arm 44 will be swung back by hand after it has been uncoupled from the disk 42 to engage said third stop during the second advance of the carriage, means being provided as is obvious to firmly retain said arm 44 in its manually adjusted position. For this purpose the plunger 53 answers the purpose the tip of the same being adapted to enter one of a series of notches or tooth spaces 43 on the periphery of the disk 42. The number of

these tooth spaces or notches is preferably twice that of the stops so as to always insure a proper positioning of the arm 44 with respect to said stops 67. It will be clear that I do not restrict myself to the means illustrated in the drawings and described herein for obtaining the independent control of the carriage.

For indexing the turret any desired means may be employed, and shown for this purpose are devices covered by my application filed May 11, 1905, Serial Number 259,981 which will now be described.

Designated by 107 is a rod mounted in a guideway of the extension 81' of the turret-slide 81, said rod having an inclined forward end 107', and secured to its under side just back of the incline is a spring 108, having a latch 108' adapted to engage the inner side of a rib 5' extending across the lower surface of the groove in the face of the abutment 4,—said latch being beveled on its under surface at 108², so that it will snap over the rib 5' and engage the rear beveled side thereof.

Rigid with the inner end of rod 107 is a head 109 having an inclined cam 110, and in a chamber of the cross- or turret-slide 81 is an angle lever 111, rigid with a rock-shaft 112, and having a stud or pin 113, in one of its arms, said stud engaging the inclined cam 110. Secured at one end to the shaft 112 and at the other end to the cross-slide is a torsion-spring 114, whose tendency is to rock said shaft and hold the pin 113 against the cam 110. A slot 115 in the head 109 permits the rocking of the shaft 112 and its arm carrying the stud 113 under the stress of spring 114 after the stud passes off the under side of said cam. In the other arm 116 of shaft 112 (the two arms constituting the angle-lever) is a pin 117, which is in contact with an arm 77' depending from the locking-bolt or slide 77, the latter having a notch 77² with flared or inclined walls to engage the inclined locking-lugs 76 on the depending ring 73 of the turret.

In the body of said locking-bolt is a slot 118 in which is fitted the turret-shaft 72. Sliding on the head 109, provided with stop 109', and extending inward therefrom is a block 119 upon which is pivoted at 120 the arm 80 carrying at its inner end the dog 80' for engaging the indexing-pins 79. Extending from this block is a rod 121 having a collar 121', and surrounding said rod is a coiled spring 122, one end of which bears against said collar and the other end against a screw 123 threaded into the slide, as illustrated in Figs. 3 and 4.

In line with the depending arm 77² of the locking-bolt 77 is a plunger 124 mounted in a chamber of the slide, and reduced and collared at 124' to receive one end of a coiled spring 125, the other extremity of which

bears against a screw 126, as illustrated in Fig. 4. Normally the locking-bolt is in engagement with one of the lugs or projections 76, and it is, therefore, necessary to withdraw said bolt before the turret can be indexed. As the carriage 7 moves to the rear carrying with it the cross-slide 81, the rod 107 will move with said cross-slide until the end thereof enters the groove in the face of the abutment 40 and the end 108' of spring 108 snaps behind the inclined rib 5', and as said carriage continues its rearward movement the rod 107 will be held stationary and the pin 113 of arm 111 will travel along the under surface of cam 110 and rocks the shaft 112, thereby causing the pin 117, of the other arm of the angle-lever to engage the inner side of the depending arm 77' of the locking-bolt, and to push said bolt rearward, against the stress of spring 25 to withdraw its inner, notched end from the stop 76 and thus release the turret, said bolt being held in its withdrawn position until the turret is indexed by the engagement of one of its depending pins 79 with the dog 80', and until the pin 113 has traversed the entire inclined surface of the cam 110. At the conclusion of the indexing operation the pin 113 leaves the end of said cam 110, enters the slot 115 of head 109, and passes into an extension 115' of said slot located above the cam,—such action being caused by the rocking of shaft 112 by the torsion-spring 114. This completes the indexing operation, and the spring-actuated plunger 124 now comes into action, and as it is in engagement with the arm 77' the locking-bolt is shot forward to engage the lug 76 of the turret opposite its notched end and again secure said turret. As the locking-bolt moves forward the arm 77' thereof engages the pin 117, and the rod 107 having been forced to normal position by the spring-actuated plunger 124, the pin 113 of the angle-lever 111 will again be brought into position for contact with the under side of the cam 110 in readiness to repeat the operation.

While the indexing and locking mechanism shown and described in my above mentioned application is employed in the present case, it is distinctly to be understood that the invention is not limited thereto, for other mechanism may be utilized for accomplishing these results if desired.

For the various kinds of work the machine is designed to accomplish it is necessary to impart a transverse movement to the turret-slide, and to arrest said movement at the point desired, and to enable these results to be carried out both automatic and manual feed-mechanisms are employed, as will now be described.

On its under side the cross-slide 81 is chambered at 81² to receive the tenon 127' of a nut 127, said tenon being internally

threaded at 127², and being locked to the cross-slide by a screw 128, as shown in Fig. 8.

In the carriage 7 is journaled a feed-screw 129, said feed-screw abutting at one end against a nose on the head of a plug 130, said plug being fitted in a bore of the carriage and abutting at its other end against the tip of a screw-bolt 131 threaded into the bore, and having a jam-nut 132 to lock it against movement after it has been adjusted. At its front end the feed-screw is journaled in a bearing-bracket 133 clamped to the carriage 7 by a screw 134 and beyond said bracket is reduced at 129' to receive separated disks 135, 135' keyed to said reduced end.

Designated by 136 is a hand-wheel having a perforated web 136', said hand-wheel being loose upon the screw-shaft, and its web being faced with leather or other friction-disks or washers 137, 137' bearing, respectively, against the keyed disks 135, 135'. Nuts 138 lock the hand-wheel in place so that when rotated it will drive the feed-screw and enable the cross-slide to be manually adjusted when the parts are in proper positions to enable this to be accomplished, but should they not be in such positions the friction-grip described will permit the hand-wheel to rotate idly without operating said screw.

It will be apparent therefore that my apparatus comprehends a traveling carriage, a stop for arresting the motion of the carriage, a screw for advancing said carriage, a hand wheel for operating the screw and movable relatively thereto, and means for transferring the effect of the wheel to the screw and for permitting motion of said wheel when the carriage strikes said stop by virtue of which no injury can result to said stop or other parts of the machine related thereto. The mechanism for accomplishing the object in question may take various forms although I have shown and described one simple and advantageous means for the purpose.

To the barrel of the screw and located in a chamber 139 of the carriage is pinned or otherwise secured a pinion 140, which engages with power-driven mechanism herein-after set forth.

On the driving-shaft 15, and splined thereto, is a worm 141, said worm engaging a worm-wheel 142.

A longitudinally perforated and flanged (at its inner end) bushing 143 is inserted in the side of the apron 13, where it is secured by a collar 144, and through said bushing passes the end of a stepped tubular shaft 145, the end of said shaft being externally threaded at 145'. Through the longitudinal perforations of the bushing pass rods 146, one of which is shown in Fig. 7, and bearing against the outer ends of the rods is a washer

147 splined upon the shaft. A nut 148 is threaded upon the end of the shaft adjacent to the washer 147, and serves when adjusted to drive the same inward against the ends of the rods.

Within the tubular shaft 145 is a rod or shaft 149, having a reduced end 149' upon which is splined a chambered knob 150 held in place by a headed screw 151, threaded into the end of the rod, the chamber of the knob inclosing the washer 147 and nut 148. At its inner end this rod is provided with a flange 149² bearing against the end of the tubular shaft and with an enlarged externally-threaded extremity 149³.

Designated by 152 is a bracket constituting practically a part of the apron 13, and to which it is secured. In the upper end of this bracket is formed a bearing 153 for the reception of the tubular hub 154' of a friction-cone 154, the hub of said cone being splined at 155 to the end of the tubular shaft 145. On its periphery this cone is inclined to fit a similarly inclined surface on the under side of the flange of the worm-wheel 142, as shown in Fig. 7. Secured by a screw 156 to a step of the tubular shaft 145 at the inner side of the worm-wheel 142, is a disk 157, said disk being faced with leather or other friction-material 158. Loosely sleeved upon the tubular shaft is another disk 159 having a hub 159' which extends along the shaft to a short distance from the hub of the disk 157. Said disk 159 is provided with a series of seats or recesses in which are inserted short coiled springs 160 which bear against a washer 161 keyed to the hub of said disk 159, and having a disk of leather or other friction-material 162 secured to its inner face. Mounted between the friction washers 158 and 162 and loosely sleeved upon the hubs of the disks 157 and 159 is a spur-pinion 163 having side plates or disks 164 164', of the diameter of the friction-washers, said side plates or disks being secured to the body of the pinion 163 by pins 165, as illustrated in Fig. 7.

Intermeshed with the pinion 163 is an idler gear 166, and said idler gear is in engagement with the pinion 140, keyed to the barrel of the feed-screw 129. A spline 167 connects the bushing 143 with the tubular shaft 145, and the disks 157, 159 are also splined to said shaft at 168, the latter being longitudinally adjustable of said tubular shaft for a purpose hereinafter stated. As will be evident the pinion 163 is held to rotate with the tubular shaft 145 by the frictional connections described, and, therefore, if, in case of obstruction of any kind, the pinion should be prevented from rotation the shaft may continue in action. By reaction of the springs 160 against the disk 161 the disk 159 is kept snugly against the end of the bushing 143, and as the hub of said disk

159 is keyed to the disk 161 it will be obvious that when it is necessary for any cause to increase the friction upon the pinion this may readily be accomplished by removing knob 150, which is splined to the reduced end of rod 149, applying a wrench to nut 148, and thus forcing the washer 147 and rods 146 inward, thereby forcing the disk 159 and the washer 161, the hub of which is splined thereto, longitudinally of the tubular shaft, and crowding the friction-disk 162 against the outer side-plate 164 of the pinion 163, thus also forcing the pinion endwise and causing its inner side-plate 164' to bear with greater pressure against the friction-surface of the disk 157, the hub of which is splined to the tubular shaft 145 as aforesaid. When this result has been accomplished the knob 150 is replaced on the reduced end of the rod 149 and the screw 151 is re-inserted in the end of said rod to secure the knob in place, after which the shaft may be actuated by hand in the manner above described.

It is a desideratum to limit positively the movement of the cross or turret-carrying slide, and to provide means whereby this movement of said slide may be controlled to enable a tool to reduce the stock carried by the usual rotary spindle (not shown) to the desired extent, or to perform other work upon the stock with precisionized accuracy, and for accomplishing these results the mechanism now to be described may be utilized, although the invention is not limited to said mechanism.

In the top of the carriage 7 a chamber 169 is formed and pinned to the bottom wall of said chamber, and transversely arranged therein is a perforated block 170. To the carriage at the outer end of the chamber is secured by screws 171, or otherwise, a bearing-block 172 for the reception of journals 173, on the outer ends of screws 174, each screw being provided with a reduced and cylindrical tip 175 which is inserted in the perforation for its reception in said block 170. At its outer end each screw is collared in its bearing 172 at 176, 176', to prevent longitudinal movement of the screw, which is provided with a rectangular head 177 for the reception of a wrench 178, whereby the screw may be rotated as illustrated in Figs. 9 and 10. Threaded into the block over the journal 173 of each screw is a bolt 179 which serves to lock the screw against rotation after it has been adjusted.

Designated by 180, and each being of like construction, are stop-blocks having flat under surfaces 180' resting upon the bottom wall of the chamber 169 in the carriage, and each also having a stop-lug or projection 181. As shown by Fig. 9 these stop-blocks are disposed in various adjusted positions upon the bottom of the chamber in the carriage, and as will be obvious, each of them

may be adjusted to any desired position by applying the wrench 178 to the squared end of the screw thereof, so that provision is made for the desired disposition of the blocks or any of them.

To the end of the cross-slide 81 is secured a bracket 182, said bracket being chambered at 183 and 184 for purposes hereinafter described, and having an extended bearing 185. In the bearing 185 is journaled a shaft 186 and keyed to the outer end of said shaft is a knob 187. Secured to the inner end of the shaft 186 and mounted in the chamber 184 of the bracket is a pinion 188, and in mesh with said pinion is another pinion 189 carried by a short shaft 190 journaled in the bracket, said shaft being provided at its inner end with a spur-gear 191 working in the chamber 183 of the bracket and said spur-gear having a series of locking notches 192 in its outer face with which engages a detent 193 backed by a spring 194, and working in a chamber of the bracket the outer end of said chamber being closed by a screw 195. On a ledge 182' of the bracket is fitted for sliding movement a rack 196 and to this rack is secured, by screws 197, and dowel-pins 198, a block 199 having a stop 200 depending from its lower side. By reciprocating the rack and block in the manner described it will be seen that this stop 200 may be placed at any desired position transversely of the chamber 169 of the carriage 7, and, consequently, may be so disposed that it may be brought opposite any of the screw stops 180. Therefore, it will be seen that when the cross slide moves transversely of the carriage, when actuated by either the power or the hand-controlled mechanism described, the limit of such movement is determined by the position of the stop 180 in line with the stop 200 of said cross-slide. When this engagement of the two stops 180 and 200 takes place the constantly-driven power mechanism would cause trouble were it not for the fact that the pinion 163 thereof is frictionally held in the manner described, therefore, when this engagement of the stops takes place the pinion will be held stationary and the friction-mechanism described will enable the power-mechanism to continue in action without danger of breakage of any of the parts of the machine. A micrometer sleeve 201 is mounted on the hub of the disk 135 to indicate the adjustment of the feed-screw. While the details of the machine and its mode of operation have been fully described a brief *résumé* of said mode of operation will now be given.

Should it be desired to run the machine by power without actuating the cross-slide automatically the knob 150 is grasped and the rod or shaft 149 rotated in a direction to withdraw the friction-cone 154 from the

worm-wheel 142, and then the continuously-driven worm 141 will rotate the worm-wheel idly upon its step of said shaft 149 and the pinion 163 will remain idle. Now, by grasping the hand-wheel 136 the screw 129 may be actuated to traverse the cross-slide 81, the gear 166 (in mesh with pinion 140) and pinion 163 idly rotating upon their supports. When, however, the stop 200 engages one of the adjustable stops 180 further rotation of the feed-screw will cease, the hand-wheel slipping between the friction-washers 137, 137' of the disks 135, 135' of said feed-screw shaft. When hand-controlled gearing is employed to reciprocate the carriage the drop-box 17 is in the lowered position shown in Fig. 12, and the worm 23 is out of engagement with the worm-wheel 24. Now by rotating the capstan-wheel 14 the pinion 9 will be driven by the gearing controlled by said wheel, and as it is in engagement with the stationary rack 8 the carriage 7 will be moved along the lathe-bed, the shaft 25 and worm 24 and pinion 27 secured thereto rotating idly, as described.

Should power-driven mechanism be required for actuating the carriage and cross-slide, the handle 29' of arm 29 is grasped, and the drop-box is raised and latched in position to engage the continuously-driven worm 23 with the worm-wheel 24, thus rotating the pinion 27, gear 28, and the shaft carrying the pinions 9 and 10, said pinion 9 being in mesh with the rack 8, as stated. Movement of the carriage toward the spindle will now take place until the lever 34 is tripped by the engagement of the stop 45 of arm 44 with the end of the one of the rods 67 it is opposite. Just as this engagement takes place the carriage moves onward a slight distance or until the stop 60 of bracket 58 (the motion of said bracket with the carriage having been arrested by the engagement of the stop described) engages the lower end 34² of lever 34, trips said lever, thereby releasing the latches on the lever and arm 29, and permits the drop-box to fall and carry its worm 23 out of engagement with the worm-wheel 24, after which the capstan-wheel is grasped and the carriage is run back. During this rearward movement of the carriage the rod 107 engages the abutment 4 and the turret is indexed in the manner above set forth, and after said rod leaves the abutment said turret is locked in place by the means set forth. During the indexing movement of the turret the cam 78 rotating with said turret actuates through the rack 84, pinion 87, shaft 88, and other mechanism described and shown in Fig. 13, the toothed disk 42, and said disk will carry with it the stop-arm 44 and bring the stop 45 at the end thereof opposite the stop-rod 67 with which it is then intended to cooperate. To throw the cross-feed mecha-

nism into action the knob 150 is grasped and the shaft 149 turned to cause the screw 149³ at the end thereof to force the friction-cone into engagement with the worm-wheel 142, thus driving the gearing described for automatically actuating the feed-screw 129 of said cross-slide, the movement of which may be arrested at any desired point by the stop 200 when it engages the stop 180 then in line with the same. Provision is thus made for both automatic and manually-controlled gearing in the same machine, and for actuating the cross-slide and carriage simultaneously, and by actuating the driving-shaft 15 by the usual reversing and stop-mechanism (not shown) automatic control of the cross-slide and carriage may be effected, so that both elements may be advanced and withdrawn by the same mechanism, if desired. It will also be apparent that I provide a slide, a stop for arresting the movement of the slide, a screw for operating said slide, a hand-wheel for operating said screw, and means for causing the hand-wheel to apply at all times a uniform power to said screw by reason of which no matter how the power applied to the said hand wheel may vary the slide will always strike said stop with the same force. I have hereinbefore described simple and effective means whereby the advantage set forth is made possible.

It is to be understood that the invention is not restricted to the precise devices shown and described for carrying out the various operations of the machine, for many changes may be made that will be within the scope of the invention, and various stop-devices different from those shown, but capable of accomplishing the same results may be employed, if desired.

Having thus described my invention, what I claim is:

1. The combination of a carriage, mechanism for feeding said carriage, a series of stops, a stop element movable with the carriage said series of stops being positioned to engage said stop element at different points in the advancing movement of said carriage, a turret supported by said carriage, mechanism operated from said turret for operating said stop element step by step to bring it into position to engage different stops of said series at different points in the travel of the carriage said series of stops being mounted on the framework and said stop element being manually adjustable whereby it may be shifted into position to engage any one of said series of stops independently of said automatic operation, and mechanism for throwing the carriage feeding mechanism out of action when any stop of said series is engaged by said stop element when the carriage is under automatic control.

2. The combination of a traveling car-

riage, a pair of stop elements one movable with the carriage and the other supported independently thereof one stop element comprising a series of stops coöperative with the other stop element to effect the stoppage of the carriage at different points in its advancing movement, means for automatically operating one of said stop elements to effect an automatic stoppage of the carriage by the engagement of said stop elements, one of the latter comprising two members one of which is manually adjustable with respect to the companion member to position the same for engagement by any one of said series of stops, and means for rigidly fastening said manually-adjustable member to said companion member.

3. The combination of a traveling carriage, a turret supported by said carriage, a series of stops supported independently of the carriage, a disk, means operable by the turret for oscillating said disk, and a stop member to engage any one of said stops angularly adjustably connected with said disk.

4. The combination of a traveling carriage, a turret supported by said carriage, a series of stops supported independently of the carriage, a disk movable with the carriage, mechanism operable from the turret for oscillating said disk, a stop member angularly adjustably connected with said disk and adapted to engage any one of said stops, a device for movably connecting said stop member and disk and adapted to normally hold said stop member in a central position, the disk having a plurality of notches which are in number twice those of said series of stops, and a detent supported by said stop member and adapted to engage any one of said notches.

5. The combination of a traveling carriage, a turret supported by said carriage, a series of stops supported independently of the carriage, a disk movable with the carriage, mechanism operable from the turret for oscillating said disk, a stop member angularly adjustably connected with the disk, a coupling device supported by said stop member the disk having an opening to receive said coupling device, and a detent also carried by the stop member, the disk being notched to receive said detent to hold the stop member in its various adjusted positions.

6. The combination, with a support, and with a series of stops mounted thereon, of means for independently adjusting said stops; a cross-slide; a carrier adjustable in a chamber of the cross-slide; a stop carried by the carrier; a rack for actuating the carrier; a gear in mesh with the rack; means for driving said gear; and means for locking said gear after the carrier has been adjusted.

7. The combination, with a carriage, and

with a driving shaft; of means operated by the driving-shaft for actuating the carriage; a cross-slide on the carriage; means operated by the driving-shaft for actuating said cross-slide; adjustable stops on the carriage; a stop on the cross-slide; and means for adjusting said stop on the cross-slide to position it for engagement with any selected stop of the carriage.

8. The combination, with a carriage, of a driving-shaft, gearing operated by said driving-shaft for actuating the carriage; a stop for limiting the advance movement of the carriage; means controlled by said stop for disengaging a driving element of said gearing; a cross-slide mounted on the carriage; means actuated by said driving-shaft for operating the cross-slide; and adjustable stop-devices for limiting the movement of the cross-slide.

9. The combination, with a carriage, and with a cross-slide, of a turret on the cross-slide; a movable stop on the carriage; a series of stops with any of which said movable stop may engage; a cam on the turret; means for indexing the turret; and means controlled by said cam for adjusting the movable stop when the turret is indexed.

10. The combination, with a carriage, of a driving-shaft; gearing, including a worm-wheel, for operating said carriage from the driving-shaft; a worm on the driving-shaft; a drop-box for said worm; means for latching the worm in engagement with the drop-box; a stop on the carriage; a device movable on the carriage, and by which said stop is carried; means carried by said device for tripping an element of the latching-mechanism, and releasing the drop-box; and a stop on the machine-bed with which the stop on the carriage is adapted to engage.

11. The combination, with a carriage, of a driving-shaft; a pinion on said driving-shaft; a drop-box sleeved upon the driving-shaft; a pinion journaled in the drop-box, and in mesh with the pinion of the driving-shaft; a latch for securing the drop-box; a worm actuated by the pinion; a worm-wheel; gearing operated by the worm-wheel for actuating the carriage; a stop movably mounted on the carriage; a cross-slide on the carriage; a turret carried by the cross-slide; a cam on said turret; means for indexing the turret; means actuated by the cam for shifting the movable stop of the carriage when the turret is indexed; a series of adjustable stops with any of which said movable stop may engage to limit the advancing movement of the carriage; and means controlled by the movable stop for tripping the latch of the drop-box.

12. The combination, with a carriage, of a cross-slide thereon; a feed-screw for adjusting said cross-slide; gearing for actuating said feed-screw; a worm; a loosely-mounted

worm-wheel; a friction-clutch; a tubular shaft; means connecting the friction-clutch with said tubular shaft; a pinion loosely mounted with relation to said tubular shaft, and connected with the gearing for actuating the feed shaft; frictionally-driven mechanism on the tubular shaft for actuating the pinion; a stop on the cross-slide; and a stop on the carriage with which the stop on the cross-slide is adapted to engage.

13. The combination, with a driving-shaft, of a carriage; mechanism actuated by the driving-shaft for operating the carriage; a tubular shaft; gearing actuated by the driving shaft for operating said tubular shaft; a clutch in said gearing; a frictionally-held pinion; a cross-slide; a feed-screw; means actuated by the frictionally-held pinion for operating said feed-screw; a stop on the carriage; and a stop on the cross-slide adapted to engage said stop on the carriage.

14. The combination, with a carriage, and with means for actuating the same, of a cross-slide on said carriage; means for actuating said cross-slide; a series of stops upon the carriage; means for independently adjusting each of said stops transversely of the carriage; a rack movable on the cross-slide; a block carried by said rack; a stop depending from the block; a pinion in mesh with the rack, said pinion having a notch; a detent for engaging said notch, and securing said pinion after the rack has been adjusted; and means carried by the cross-slide for actuating the pinion.

15. The combination, with a driving-shaft, of a slide; a support for said slide; means for actuating said slide; a gear actuated by the driving-shaft; a shaft upon which said gear is mounted; a clutch for locking said gear to said shaft; a frictionally-held pinion carried by the shaft; means actuated by the frictionally-held pinion for actuating the mechanism for actuating the slide; a stop on the slide; and a stop on the support with which the stop on the slide is adapted to engage.

16. The combination, with a carriage having an apron, said apron provided with a guideway, of a bracket mounted in said guideway, and having an arm at an angle to said bracket; a shaft passing through the carriage-apron; a sleeve rigid with said shaft, and mounted in a bearing of the angular arm of the bracket; a stop-arm carried by the sleeve; a stop on the machine-frame for engaging said stop-arm, and shifting the bracket longitudinally; a pivoted latch-lever; a stop projecting from the bracket, and adapted to engage the lower end of the pivoted latch-lever; a driving-shaft; a drop-box sleeved upon said driving-shaft; a pinion on the driving-shaft; a shaft journaled in the drop-box; and driven by said pinion; an arm projecting from said

drop-box, and having a latch-element to engage the latch-lever; a rack on the frame-work; and gearing connecting the shaft journaled in the drop-box with said rack.

- 5 17. The combination, with a carriage, and with a cross-slide thereon, of a turret supported on the cross-slide; means for indexing the turret; a reciprocatory plunger; devices controlled by the turret for actuating
10 said plunger in one direction when the turret is indexed; a spring for returning the plunger; a rack on the plunger; a shaft journaled in the apron of the carriage; a pinion on said shaft, and in mesh with the
15 rack; a sleeve rigid with said shaft, and having projecting hubs; a toothed disk rigid with the sleeve; an arm sleeved upon one of the disk-hubs; a spring-actuated detent engaging the teeth of the disk and carried by
20 the arm; a stop also carried by the arm; a stop on the frame, and cooperating with said stop of the arm; a power-drive for the carriage; and means actuated by the stop-arm when it engages the stop of the frame for
25 releasing the said power-drive, and arresting the movement of said carriage.

18. The combination, with a lathe-bed, of an abutment having a grooved face, and adjustable longitudinally thereon; a carriage;
30 a cross-slide on the carriage; a turret; devices for indexing said turret; a movable rod mounted on the cross-slide and connected with the turret-indexing devices; and a latch for engaging the end of said rod
35 with part of the grooved face of the abutment.

19. The combination, with a lathe-bed, of a carriage, a cross-slide; a turret; turret-indexing devices; a rod for actuating said
40 devices; an abutment having a wide face, said face being grooved, and a wall of the groove having a catch; and a latch carried by the rod, and snapping over said catch when the end of the rod enters said groove.

- 45 20. The combination, with a carriage, of a series of separated stops located in parallel planes, and adjustable thereon; a cross-slide on the carriage; a chambered bracket secured to the cross-slide, and having a bearing;
50 a shaft journaled in said bearing; a slide movable in a chamber of the bracket; gearing actuated by the shaft for operating the slide; and a stop carried by said slide.

21. The combination, with a carriage, provided with an apron, of a cross-slide mounted on the carriage; means for actuating said cross-slide; a gear-train carried by the apron; a tubular shaft journaled in the carriage; a rod passing through said tubular shaft, and having a thread at one end, and a knob at its opposite extremity; a friction-cone having a hub journaled in the bearing of a part of the carriage, said hub being internally-threaded to engage the thread of
60 the rod; a worm-wheel loose upon the tu-

bular shaft, and adapted to be clutched thereto by the friction cone; means for actuating said worm-wheel; means for connecting the friction-cone with said tubular shaft; a pinion frictionally held upon the tubular shaft; and means for connecting said pinion with the mechanism for actuating the cross-slide. 70

22. The combination, with a carriage provided with an apron, of a bushing mounted in said apron; a tubular shaft journaled at one end in the bushing; a friction-cone having a hub journaled in a bearing of part of the carriage, and in which hub the other end of said tubular shaft is splined; a worm-wheel loose on the tubular shaft adjacent to the friction-cone; disks having hubs, one of which is secured to the tubular shaft, and the other of which is splined thereon; friction-washers; a disk keyed to the hub splined
80 upon the tubular shaft; springs bearing against said disk; rods passing through the bushing and engaging the spring-carrying disk; means for adjusting said rods; a pinion having connected side-plates mounted
90 on said hubs; a cross-slide; and mechanism actuated by the pinion for operating said cross-slide.

23. The combination, with a carriage having an apron, and with a cross-slide mounted on said carriage, of a screw for actuating said cross-slide; a pinion on said screw; an idler in engagement with said pinion; a tubular shaft carried by the apron and carriage; a disk having a series of recesses and a hub, the end of which is splined to said tubular shaft; springs in said recesses; a second disk keyed to the hub of the first-named disk; means for adjusting said first-named disk; a friction-washer; a disk having a hub secured against longitudinal movement to the tubular shaft; a friction-washer mounted on said disk; and a pinion having connected side-plates bearing against the friction-washers, said pinion engaging
100 the idler.

24. The combination, with a carriage having an apron, and with a cross-slide mounted on said carriage, of a screw for actuating said cross-slide; a pinion on said screw; an idler in engagement with said pinion; a tubular shaft carried by the apron and carriage; means for rotating the tubular shaft; a disk having a series of recesses, and a hub, the end of which is splined to said tubular shaft; springs in said recesses; a second disk keyed to the hub of the first-named disk and against which said springs bear; means for adjusting said first-named disk; a friction-washer; a disk having a hub secured against longitudinal movement to the tubular shaft; a friction washer mounted on said disk; a pinion having connected side-plates bearing against the friction-washers, said pinion engaging the idler; a stop on the
110 115 120 125 130

cross-slide; and a stop on the carriage with which said stop on the cross-slide is adapted to engage.

25. The combination, with a carriage having an apron, and with a cross-slide mounted on said carriage, of a screw for actuating said cross-slide; a pinion on said screw; an idler in engagement with said pinion; a tubular shaft carried by the apron and carriage; a disk having a series of recesses, and a hub the end of which is splined to said tubular shaft; springs in said recesses; a second disk keyed to the hub of the first named disk; means for adjusting said first named disk; a friction-washer; a disk having a hub secured against longitudinal movement to the tubular shaft; a friction-washer mounted on said disk; a pinion having connected side-plates bearing against the friction-washers, said pinion engaging the idler; a stop on the carriage, and a stop on the cross-slide adapted to engage said carriage stop.

26. The combination, with a carriage, having an apron, said apron provided with a guideway of a bracket movable upon said guideway, and having a stop; a lever pivoted to the apron, and provided with a latch; a driving-shaft; a drop-box sleeved upon said driving-shaft, and provided with an arm having a catch coöperating with said latch; gearing connecting said drop-box with the carriage; a series of stop-rods adjustably secured to the frame of the machine; a swinging-stop carried by the apron and engaging said bracket; a turret mounted on the cross-slide; a cam on said turret;

and means for connecting said cam with the swinging-stop.

27. The combination of a slide, a stop for arresting the movement of the slide, a hand wheel, a screw for operating said slide, the hand wheel being movable with respect to said screw, and means for transferring the effect of the hand wheel to the screw for operating said slide and for permitting relative motion of said hand wheel when the slide is arrested by said stop.

28. The combination of a slide, a stop for arresting the movement of the slide, a hand wheel, a screw for operating said slide, the hand wheel being movable with respect to the screw, and friction means for transferring the effect of the hand wheel to said screw for operating said carriage and for permitting relative motion of the wheel with respect to said screw when the slide is arrested by said stop.

29. The combination of a slide, a stop for arresting the movement of said slide, a screw for operating said slide to bring the same against said stop, a hand-wheel for actuating the screw, and means for always causing the said hand wheel to exert a uniform force upon the said screw whereby the pressure of the slide against said stop will be always the same irrespective of the power applied to said hand-wheel.

In testimony whereof I affix my signature in presence of two witnesses.

BENGT M. W. HANSON.

Witnesses:

KATH. T. M. O'CONNELL,
 SOLON E. DAVIS.